

CLAIMS

## WHAT IS CLAIMED IS:

1. A method for varying conductivity of a poly(3,4-ethylenedioxythiophene)/poly(styrenesulfonate) layer cast  
5 from aqueous solution onto a substrate, said method comprising adding an effective amount of at least one co-solvent to said aqueous solution.
2. A method according to claim 1, wherein said at least one co-solvent comprises an organic solvent.
3. A method according to claim 2, wherein said organic solvent  
10 comprises a solvent selected from ether solvents, alcohol solvents, alcohol ether solvents, ketone solvents, nitrile solvents, sulfoxide solvents, amide solvents, amine solvents, carboxylic acid solvents, and combinations of any two or more thereof.
4. A method according to claim 3, wherein said organic solvent  
15 comprises an ether solvent.
5. A method according to claim 4, wherein said ether solvent comprises a solvent selected from diethyl ether, ethyl propyl ether, dipropyl ether, disopropyl ether, dibutyl ether, methyl t-butyl ether, glyme, diglyme, benzyl methyl ether, isochroman,  
20 2-phenylethyl methyl ether, n-butyl ethyl ether, 1,2-diethoxyethane, sec-butyl ether, diisobutyl ether, ethyl n-propyl ether, ethyl isopropyl ether, n-hexyl methyl ether, n-butyl methyl ether, methyl n-propyl ether, and combinations of any two or more thereof.
6. A method according to claim 3, wherein said organic solvent  
25 comprises an alcohol solvent.
7. A method according to claim 6 wherein said alcohol solvent comprises a solvent selected from methanol, ethanol, 1-propanol, 2-propanol (i.e., isopropanol), 1-butanol, 2-butanol, 2-methyl-1-propanol (i.e., isobutanol), 2-methyl-2-propanol (i.e., *tert*-butanol), 1-pentanol, 2-pentanol, 3-pentanol, 2,2-dimethyl-1-propanol, 1-hexanol, cyclopentanol, 3-methyl-1-butanol, 3-methyl-2-butanol, 2-methyl-1-butanol, 2,2-dimethyl-1-propanol, 3-hexanol, 2-hexanol, 4-methyl-2-pentanol, 2-methyl-1-pentanol, 2-ethylbutanol, 2,4-dimethyl-3-pentanol, 3-heptanol, 4-heptanol, 2-heptanol, 1-heptanol, 2-ethyl-1-hexanol,  
35 2,6-dimethyl-4-heptanol, 2-methylcyclohexanol, 3-methylcyclohexanol, 4-methylcyclohexanol, and combinations of any two or more thereof.

8. A method according to claim 6, wherein said alcohol solvent comprises a solvent selected from methanol, ethanol, or isopropanol.
9. A method according to claim 6, wherein said alcohol solvent comprises isopropanol.
- 5 10. A method according to claim 3, wherein said solvent comprises an alcohol ether solvent.
11. A method according to claim 10, wherein said alcohol ether solvent comprises a solvent selected from 2-butoxyethanol, 1-methoxy-2-propanol, 2-methoxyethanol,
- 10 2-ethoxyethanol, 1-methoxy-2-butanol, ethylene glycol monoisopropyl ether, 1-ethoxy-2-propanol, 3-methoxy-1-butanol, ethylene glycol monoisobutyl ether, ethylene glycol mono-*n*-butyl ether, 3-methoxy-3-methylbutanol, ethylene glycol mono-*tert*-butyl ether, and combinations of any two or more thereof.
- 15 12. A method according to claim 10, wherein said alcohol ether solvent comprises a solvent selected from 2-butoxyethanol, 1-methoxy-2-propanol, or 2-methoxyethanol.
13. A method according to claim 10, wherein said alcohol ether solvent comprises
- 20 2-butoxyethanol.
14. A method according to claim 3, wherein said organic solvent comprises a ketone solvent.
15. A method according to claim 14, wherein said ketone solvent comprises a solvent selected from acetone, methylethyl ketone, methyl
- 25 iso-butyl ketone, cyclohexanone, isopropyl methyl ketone, 2-pentanone, 3-pentanone, 3-hexanone, diisopropyl ketone,
- 2-hexanone, cyclopentanone, 4-heptanone, iso-amyl methyl ketone, 3-heptanone,
- 2-heptanone, 4-methoxy-4-methyl-2-pentanone, 5-methyl-3-
- 30 heptanone,
- 2-methylcyclohexanone, diisobutyl ketone, 5-methyl-2-octanone, 3-methylcyclohexanone, 2-cyclohexen-1-one, 4-methylcyclohexanone, cycloheptanone, 4-*tert*-butylcyclohexanone, isophorone, benzyl acetone, and combinations of any two or more thereof.
- 35 16. A method according to claim 3, wherein said organic solvent comprises a nitrile solvent.
17. A method according to claim 16, wherein said nitrile solvent comprises a solvent selected from acetonitrile, acrylonitrile, trichloroacetonitrile, propionitrile, pivalonitrile, isobutyronitrile, *n*-

butyronitrile, methoxyacetonitrile, 2-methylbutyronitrile, isovaleronitrile, n-valeronitrile, n-capronitrile, 3-methoxypropionitrile,

3-ethoxypropionitrile, 3,3'-oxydipropionitrile, n-heptanenitrile, glycolonitrile, benzonitrile, ethylene cyanohydrin, succinonitrile, acetone  
5 cyanohydrin,

3-n-butoxypropionitrile, and combinations of any two or more thereof.

18. A method according to claim 3, wherein said solvent comprises a sulfoxide solvent.

10 19. A method according to claim 18, wherein said sulfoxide solvent comprises a solvent selected from dimethyl sulfoxide (DMSO), di-n-butyl sulfoxide, tetramethylene sulfoxide, methyl phenyl sulfoxide, and combinations of any two or more thereof.

20. A method according to claim 18, wherein said sulfoxide  
15 solvent comprises a solvent selected from dimethyl sulfoxide (DMSO) and di-n-butyl sulfoxide.

21. A method according to claim 18, wherein said sulfoxide solvent comprises dimethyl sulfoxide (DMSO).

22. A method according to claim 3, wherein said organic solvent  
20 comprises an amide solvent.

23. A method according to claim 22, wherein said amide solvent comprises a solvent selected from dimethyl formamide (DMF), dimethyl acetamide, acylamide, 2-acetamidoethanol, N,N-dimethyl-*m*-toluamide, trifluoroacetamide,

25 N,N-dimethylacetamide, N,N-diethyldodecanamide,  $\epsilon$ -caprolactam, N,N-diethylacetamide, N-tert-butylformamide, formamide, pivalamide, N-butyramide, N,N-dimethylacetoacetamide, N-methyl formamide, N,N-diethylformamide,

30 N-formylethylamine, acetamide, N,N-diisopropylformamide, 1-formylpiperidine, N-methylformanilide, and combinations of any two or more thereof.

24. A method according to claim 22, wherein said amide solvent comprises a solvent selected from dimethyl formamide (DMF), dimethyl acetamide, and acylamide.

35 25. A method according to claim 22, wherein said amide solvent comprises dimethyl formamide (DMF).

26. A method according to claim 3, wherein said organic solvent comprises an amine solvent.

27. A method according to claim 26, wherein said amine solvent comprises a solvent selected from a mono-, di-, or tri-alkyl amine, a cyclic amine, an aromatic amine, and combinations of any two or more thereof.

28. A method according to claim 26, wherein said amine solvent  
5 comprises an aromatic amine solvent.

29. A method according to claim 28, wherein said aromatic amine comprises pyridine.

30. A method according to claim 3, wherein said organic solvent comprises a carboxylic acid solvent.

10 31. A method according to claim 30, wherein said carboxylic acid solvent comprises a solvent selected from a C<sub>1</sub> up to about C<sub>6</sub> straight or branched chain carboxylic acid, and combinations of any two or more thereof.

15 32. A method according to claim 30, wherein said carboxylic acid comprises formic acid.

33. A method according to claim 1, wherein said at least one co-solvent comprises in the range of about 0.5 wt% up to about 70 wt% of the aqueous solution.

20 34. A method according to claim 33, wherein said at least one co-solvent comprises in the range of about 0.5 wt% up to about 35 wt% of the aqueous solution.

35. A method according to claim 34, wherein said at least one co-solvent comprises in the range of about 0.5 wt% up to about 10 wt% of the aqueous solution.

25 36. A method according to claim 35, wherein said at least one co-solvent comprises in the range of about 0.5 wt% up to about 2.5 wt% of the aqueous solution.

30 37. A method for increasing thickness of a poly(3,4-ethylenedioxythiophene)/poly(styrenesulfonate) layer cast from aqueous solution onto a substrate, said method comprising adding an effective amount of at least one co-solvent to said aqueous solution.